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EFFECTS OF A TECHNOLOGY TREATMENT ON STUDENT SCORES ON THE
STANDARDIZED GRADE 8 PROFICIENCY ASSESSMENT (GEPA) IN NEW
JERSEY

BY

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Submitted in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education
Seton Hall University

2008

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ABSTRACT

EFFECTS OF A TECHNOLOGY TREATMENT ON STUDENT SCORES ON THE STANDARDIZED GRADE 8 PROFICIENCY ASSESSMENT (GEPA) IN NEW JERSEY

This experiment illustrates how the effective use of a technology treatment integrated into pre-algebra curricula can help students achieve on the New Jersey Standardized Grade 8 Proficiency Assessment (GEPA). The researcher obtained data by comparing a treatment group to a control group; the first group was given a weekly 44-minute-long technology treatment (called the Study Island program) for 15 weeks, whereas the other group did not receive this treatment at any time during the experiment.

The following two research questions were addressed for the experiment and for determining recommendations for future research:

1. What effect does the 44-minute, weekly technology treatment (Study Island) have on students' mathematical achievement on the GEPA?
2. What effect does participation in the Study Island program, students' GPAs, and attendance rates have on different GEPA scores between the treatment group (1) and nontreatment group (2) when one controls for prealgebra curriculum?

The researcher collected data from Central Regional Middle School, which has been placed in the District Factor Group (DFG) B by the State of New Jersey according to several socioeconomic factors and indicators. There are eight DFGs, ranging from low (A) to high (J). The researcher compared the mean mathematics test scores of the control group and the treatment group to the DFG mean scores listed by the New Jersey Department of Education's 2005 G.E.P.A. report.

Table 1

Average Statewide (New Jersey) Assessment Score, by DFG (2005)

DFG	ESPA		GEPA			HSPA	
	Lang	Arts Math	Lang	Arts Math	Science	Lang	Arts Math
A Low	208.9	199.4	201.0	191.3	201.4	209.9	197.4
B	214.1	210.3	213.4	206.4	217.4	221.0	212.3
CD	218.3	219.0	217.2	208.7	224.0	224.7	216.2
DE	221.8	224.8	221.9	214.6	228.6	228.3	220.5
FG	224.1	229.3	224.9	220.5	232.3	230.9	226.2
GH	226.1	233.4	227.8	225.7	235.2	234.6	231.2
I	230.6	240.4	233.4	231.8	240.1	240.1	239.6
J High	233.8	247.1	238.5	238.6	244.0	244.1	244.8

The control group's mean average score for the mathematics portion of the GEPA (206.8) mirrored the DFG average, which was 206.4. The experimental group's average, however, was significantly higher, with a mean score of 242.7 (see Table 1).

Based on this evidence, the researcher concluded that the technology treatment was a success; recommendations for policy, practice, and further study are also provided within the study.

ABSTRACT

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DEDICATION

I would like to dedicate this work to my parents, Angie and Wallace Parlapapides, who have served as the inspiration, motivation, and foundation for the man I have become. Being first-generation Greek Americans who learned English as a second language, my parents stressed achieving the American dream through education. They sacrificed by working three jobs to provide their children with an education while still instilling in them a set of moral beliefs, ideals, sense of responsibility, and the decency to handle every situation life has to offer.

I only hope I can provide one quarter of the support, love, and patience they've shown me to my own children some day.

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Chapter I

INTRODUCTION

Background of the Problem

During the 1990s, educators sought to identify the multiple variables that determine educational success. Variables such as student aptitude and motivation are important, but educators cannot always influence them. Teachers in the 21st century must meet the extraordinary needs of many children who live in poverty; many of these students come from single-parent homes and have limited access to social and educational resources (Ravitch & Viteritti, 2000). Additionally, prior learning, which is another indicator of how well a student will do in school, is best facilitated in the lower grades.

In the field of mathematics, there is a great divide between those who promote teaching through the presentation of real-world problems (“fuzzy” math to critics) and those who prefer to emphasize basic skills (what critics call “drill and kill”). This divide has stifled well-meaning attempts to improve the teaching and learning of mathematics, and its collateral damage to young people’s educational opportunities has been severe (Daro, 1999).

In August 2000, 54 million U.S. households, or 51%, had one or more computers, which was up from 42% in December 1998. Even more intriguing, nearly two-thirds (65%) of all children 3 to 17 years old lived in households with computers in 2000, up

from 55% in 1998 (U.S. Bureau of the Census, 2000). This access to technology—combined with the existence of 80 online charter schools in the United States that over 28,000 students attend—indicates that technology has become the next trend in education (Cavanagh, S., 2007).

This trend is not limited to the wealthiest districts. The U.S. Census Bureau (2000) reported that 87% of those who lived in wealthy districts used a computer, compared with 72% of those who lived in low-income districts; this presented a mere 15% difference in computer accessibility between students in wealthy districts and those in poorer districts. These data would indicate that computer access in schools is not limited primarily by income, race, or ethnicity.

Additionally, an analysis of student computer use in 2003 found that family income had relatively little impact on the percentage of children who used computers at school. Although 86% of the students from families with the highest incomes used computers at school, 80% of students from low-income families had similar access. The gap created by income regarding computer use at home, however, was far more substantial. The rate of at-home computer use among children from families earning under \$20,000 a year was less than half the usage rate of students whose families had annual incomes of at least \$75,000. In fact, students in the top bracket tended to use computers more at home than in school (Cavanagh, S., 2007).

According to Glennan and Melmed (1996), “The availability of computers nationally has increased in recent years, from a computer for every 125 students in 1983 to a computer for every nine students in 1995” (p. 49). By 2000, availability had improved to five students per computer; however, this statistic only includes the use of

ordinary computers. Between 1997 and 1999, the availability of multimedia computers improved from twenty-one students per machine to fewer than 10 per machine; there were similar drops in the ratio of students to Internet-connected computers (Fleischman, 1999). During this time, computer use was dictated by teachers' knowledge and ability to integrate technology into curricula. The computers were primarily used to teach basic math skills and were used differently in each classroom and district.

Accountability for student achievement in public school systems first became a national issue when the Reagan administration released its report *A Nation at Risk* (National Commission on Excellence in Education [NCEE], 1983). Public schools were suddenly placed under a microscope and examined by special-interest groups, parents, politicians, and the press. As reported by the NCEE (1983), President Reagan said (in a 1982 message to the National Academy of Sciences), "This public awareness—and I hope public action—is long overdue . . . This country was built on American respect for education . . . Our challenge now is to create a resurgence of that thirst for education that typifies our Nation's history" (p. 2). To that end, Congress authorized the federal "Education Rate," or E-rate, program as part of the Telecommunications Act of 1996. Over the past decade, the E-rate program has provided an annual subsidy of \$2 billion for schools to pay for telecommunications services and access to the Internet; the largest proportion of the money goes to schools with the greatest poverty (Bracey, G. W., 2005).

In terms of achievement, the Third International Mathematics and Science Study (TIMSS, 2003) found that eighth graders from Japan and Hong Kong scored higher on their mathematics assessments than students in the United States did. Additionally, U.S. students scored, on average, lower than their peers in six other countries, whereas five

Asian countries reported world-class performance levels in mathematics. Fourth graders in the United States scored close to the international average in mathematics and science, whereas eighth graders scored slightly above the international average in science and slightly below in mathematics (U.S. Department of Education, 2003). The message sent by the TIMMS echoed what many had suspected: U.S. students were losing ground in the world.

Bracey (2000), however, argued that the TIMMS report was not an accurate reflection of math and science achievement in American students, noting that “American students were mostly not age-mates of those [students] in other countries” (p. 4). In the math and science literacy assessment, many international students in the TIMSS sample were up to 3 years older than students in the U.S. sample; therefore, Bracey concluded that American students may have had up to 3 fewer years of math and science instruction than students from other nations did.

Additionally, Mathews (2002) noted that, in many parts of the United States, there was an aggressive effort to focus on algebra. Mathews claimed that in some school districts and in one large state (California), educators and others wanted every student to complete algebra, which they saw as “a gateway to higher math and science,” by the end of the eighth grade (p. 4). Mathews also cited a *Washington Post* survey, however, reporting that, at the national level, only 25% of eighth graders were enrolled in algebra or higher level classes.

Students completing advanced math courses such as Algebra II enjoy clear benefits through having college success and getting good jobs. To demonstrate, roughly 84% of young workers holding the 25% top-paying jobs have finished at least one

yearlong course in Algebra II or a higher level math class (Carnevale & Desrochers, 2003).

Research also showed that U.S. eighth graders had more access to computers and the Internet at home and at school than their counterparts in other nations did. The TIMSS (2003) reported that 80% of the U.S. students in the study had computers in their homes, whereas 45% of students in other studied countries did. Additionally, “fifty-nine percent of these students also reported that they had Internet access at home, 76 percent reported access at school and 81 percent reported access elsewhere; all of these percentages were greater than the international average” (TIMSS, 2003, p. 23).

In New Jersey, student scores on the GEPA are reported as partially proficient, proficient, or advanced proficient. Eighth-grade students are assessed annually in three areas: language arts, science, and mathematics. (Under No Child Left Behind [NCLB] legislation and as of 2008, testing is now also required for Grades 3–7 and 9, but the data collected for the present study focused primarily on Grade 8 math scores.) Once the GEPA is scored, results are returned to individual school districts, and these results are often published in local newspapers. This assessment arrangement could change, however, as the United States Sixth Circuit Court of Appeals declared NCLB unconstitutional on January 7, 2008. If the decision is not overturned, testing mandates could be seen as wrong in the future.

Mathematics results of the 2005 GEPA showed that, on average, 38.3% of students were assessed as being partially proficient, 41.7% were proficient, and 20.0% were advanced proficient (New Jersey Department of Education [NJDOE], 2005). The

average mean in the researcher's district was significantly higher than the average presented by the NJDOE.

With the increased pressure to teach computer literacy, and with the integration of technology into the curriculum at the undergraduate teacher-preparation level, it is important to examine teachers' computer skills. A 2005 study showed that 81% of the new teachers in New Jersey had intermediate, advanced, or instructor-level computer skills. The study also showed that one multimedia computer was available for every 4.4 students, and 92.7% of all local school districts in the state had technology coordinators. Internet access in classrooms, offices, and media centers was nearly 100%, with a staggering access rate of 95.8% for students (NJDOE, 2005).

Are the costs of implementing and maintaining technology worth it? District leaders need to establish a technology plan; they also need to determine initial costs and future expenditures, which in some cases exceed startup costs. District leaders must consider such factors as wiring, wireless access, hardware, software, and staff training, as well as the cost of having a technician maintain the system. With New Jersey legislators passing Senate Bill 1701, which increased school districts' annual budgets by only 3% over the previous year, district leaders became faced with difficult decisions; additionally, the technology plan—originally projected to take 5 years—could take 10 years to complete. Unfortunately, with technology changing so rapidly, anything 3 years old or older can easily become obsolete.

In examining teachers' ability to integrate computers into lessons, a 1999 study by Market Data Retrieval (Heller, 1999.) found that "61 percent of the teachers surveyed felt

either ‘not at all prepared’ or only ‘somewhat prepared’ for integrating technology into their lessons” (p. 38).

Meanwhile, Wenglinsky’s (1998) national study of technology effectiveness used National Assessment of Education Progress (NAEP) data in mathematics to show that technology can indeed be effective in increasing mathematics achievement and other education outcomes; however, the degree of effectiveness depends on how technology is used (Wenglinsky, 1998). Most textbook series provide a tutorial or some type of online resource for students to supplement classroom instruction. Because most middle-school students take Prealgebra or Algebra I, computer software can be used as a tutorial or resource because most problems have one answer. A computer program can determine if the student answered correctly and then provide a tutorial for those students who answered incorrectly. This combination of classroom instruction and software tutorials can serve as a useful tool in mathematics instruction. NCES, upon review of a congressionally mandated evaluation of NAEP, determined that achievement levels should be used on a trial basis and should be interpreted with caution (USDOE, 2003).

What influence does technology have on education and, in particular, on mathematical achievement? Technology advocates suggest that technology transforms the classroom when integrated into the curriculum. Glennan and Melmed (1996) argued that the benefits of computer, Internet, and software access generally fall into the following five categories: support for individual learning, group learning, instructional management, communication, and administration.

Although critics may agree that a technology-infused curriculum has potential to transform the classroom, some critics state that technology is doomed from the get-go

because no matter how many computers are available in the classroom, they are unlikely to have much impact on students if teachers are unwilling to use them for instruction (Cuban, 1993, p. 32).

Statement of the Problem

The “productivity paradox” in education is similar to that affecting the business sector during the Reagan era. At that time, people wondered whether increased investments by the private sector were making a difference. As Peters (2003) stated, “The jury is clearly out on whether education will soon experience an equivalent bump in student achievement to the one realized by industry as a result of educational technology investments” (p. 21). Today, educators are seeking answers to determine how technologies integrated into curricula and classrooms influence student achievement. Peters noted that “the bottom line is that educational technology applications do not so much replace existing teaching and learning as they do supplement them; whether they are better than traditional forms of instruction remains unclear” (p. 45).

In the current study, the researcher attempted to determine if the Study Island computer program—given to 120 randomly selected eighth-grade students over the course of 15, 44-minute weekly sessions—had a measurable impact on GEPA math scores. Results from the program evaluation were compared with those obtained from a control group of another 120 randomly selected eighth-grade students; these students were not exposed to the Study Island program over the 15-week period.

Purpose of the Study

The purpose for this study was to examine possible improvements in mathematics instruction. Such examinations are lacking in education research, as is shown in a federal

research review's conclusion that "most of the off-the-shelf mathematics programs used in middle schools across the country have little or no rigorous evidence attesting to their effectiveness" (Roth, K, 2004, p. 25). Research into the reading programs used in various states has outlined increases in standardized testing. Because Central Regional Middle School is part of a regional school system, the school's leadership must acknowledge and address students' low achievement scores on the mathematics portion of the GEPA. To do this, administrators chose to implement a computer mathematics program offered in 15, 44-minute weekly sessions. Results of the current study will contribute to the growing amount of research being undertaken in mathematics and technology.

Significance of the Study

This study's significance arises from the following situation: School districts spend a large amount of money on technology, and current mathematical research is limited by nature and warrants further investigation. According to Cuban (2001), "There have been no advances over the last decade that can be confidently attributed to broader access to computers. The link between test score improvements and computer availability and use is even more contested" (p. 45). Thus, the present study has the potential to add to existing knowledge about the relationship between computer availability and use and student test (in this case, GEPA) scores.

Additionally, results from this and similar studies may influence district policy. If there is a strong positive correlation between the outcomes of using computer technology and high test scores or academic achievement, then district leaders could rewrite curricula to incorporate greater use of computers in the classroom. If there is a weak or negative correlation between computer use and achievement, then administrators might conclude

that student achievement can be heightened by other teaching techniques or curricula designs, and the emphasis on computers for test-score gains might be reduced.

Summary of Design and Method

The 120 randomly selected eighth-grade students (1, or experimental group) were removed from physical education classes 1 day a week for the treatment. They were only removed for one class period because current (2008) elementary school law requires that students receive 150 minutes of physical education a week. Over the course of the study, this requirement was met through 4 days of physical education totaling 176 minutes a week. (There were six classes with the same instructor; each class had an average of 20 students.) The other 120 eighth-grade students (0, or the control group) in the study were also randomly selected. These students did not receive the Study Island mathematics treatment; instead, they attended physical education courses the full 5 days a week. Both groups were completing the prealgebra curriculum, and each student's GPA, attendance record, and involvement with the technology treatment were used in a hierarchical linear regression to analyze several models. The researcher then used ANOVA to determine if the main effects were significant.

Research Questions

Two primary questions guided this study. They were as follows:

What effect does the 44-minute weekly Study Island program have on students' mathematical achievement on the GEPA?

How do the main effects of GPA after the third marking period, student attendance, and involvement in Study Island impact GEPA score differences between those in the treatment group (1) and the nontreatment group (0)?

Null Hypotheses

Ho 1: No difference exists between the GEPA math scores of students who received the technology treatment and the scores of students who did not.

Ho 2: When the researcher controls curriculum based on eighth-grade mathematics GPAs, attendance, and involvement in the technology treatment, no difference exists between the GEPA math scores of students in the treatment group and the scores of those in the nontreatment group.

Delimitations and Limitations

Several delimitations were placed on the study. The students were delimited to those not enrolled in special education or honors programs; this allowed the researcher to focus on a standard prealgebra curriculum for eighth-grade students (Hitlin, P., Rainie, L. 2005).

Additionally, the study was delimited to analyzing the effect on outcomes (test scores) of a mathematical technology program (treatment) on student achievement for 120 randomly selected students. These students' outcomes were compared with outcomes of 120 randomly selected eighth-grade students in a nontreatment group.

The data for this study were also delimited to the 2005 Central Regional Middle School Mathematic GEPA results. Because GEPA scores only from students at Central Regional Middle School were used, discussion of results must be limited to similar schools and systems.

It is important to note that some teachers in the district where the study was conducted were concerned about the effectiveness of the Study Island program and the degree to which it was adequate in teaching students to meet state standards for prealgebra courses. Gender was also a limitation, as the researcher did not evaluate whether male students fared better than female students during this study and vice versa. (In this area, a 2005 study conducted at Michigan and Penn State expanded on past research by showing that parents' opinions and behaviors are factors in determining male and female interest and confidence in math and science [*Hoff, D*, 2007, p. 8].)

Race was also a limitation in the current study; the researcher did not examine how minority students performed compared with White students. Additionally, because students were prompted to answer a number of questions at home, as the Study Island program is Web-based, students were limited by their own self-motivation. The researcher was also concerned about the equivalence of the program's implementation in each class. Because the researcher was not involved in selecting teachers to administer the treatment or in training these teachers to use the program, he could not verify the quality of the instructors, and this created a major limit in the generalizations that could be drawn from the study. This limit in consistency was also apparent when considering the training and professional-improvement plans of teachers presenting the prealgebra curriculum.

Methods

The GEPA scores of the nontreatment, or control, group (0) comprised the dependent variable during the statistical analysis. The test data collected from the 120 students in the treatment, or experimental, group (1) comprised the independent variable.

Definition of Terms

The following definitions are important for ensuring a clear understanding of the study and resulting narrative.

Computer-Assisted Instruction (CAI) – In CAI, the computer delivers instruction to students. This method of instruction is designed to teach, guide, and test students until these students attain a desired level of proficiency.

Curriculum – For the purposes of the current study, the word *curriculum* refers to the prealgebra instruction given to all eighth-grade students in the chosen district.

District Factor Group (DFG) - DFG is a designation given to each New Jersey school district based on its socioeconomic status (NJDOE, 2005). See the Appendix for more information about the DFG.

Educational Practice – Educational practices refer to procedures, policies, or instructional techniques that guide how education is delivered to students (Carta, 1995).

Grade 8 Proficiency Assessment (GEPA) – The GEPA is administered annually to all New Jersey eighth graders in the following subjects: language-arts literacy, mathematics, and science (NJDOE, 2004).

The National Assessment of Education Progress (NAEP) – A federally funded organization that measures educational progress.

Nontreatment Group – This group was comprised of 120 randomly selected eighth graders who were not removed from physical-education classes to participate in the Study Island program.

Study Island – Study Island is a Web-based computer program that is aligned with the New Jersey Core Curriculum Standards (NJCCS). The 120 randomly selected students who were removed from physical-education classes participated in the Study Island program once weekly for 15 weeks.

Technology Treatment – In the present study, the students used the Study Island program for 44 minutes a week over a 15-week period.

Chapter I Summary and Organization of Remainder of Study

Chapter I introduced the national and local contexts framing this study's problem statement, research questions, null hypotheses, purpose, and significance. It also detailed the study's limitations and delimitations.

Chapter II provides a review of research and literature that support the current study's relevance within the larger context of published works.

Chapter III outlines the study's design and methodologies, including data collection processes and preliminary comparisons of populations to samples.

Chapter II

REVIEW OF RESEARCH, THEORY, AND LITERATURE

In Chapter II, the researcher presents a review of research and literature supporting the current study's relevance within the larger context of published works. The synopsis includes an examination of the views proponents and critics have historically taken regarding the integration of technology into curricula and the implementation of programs in state-led education systems.

Since 1996, state- and district-level agencies have invested over \$10 billion to acquire and integrate computer-based technologies into American schools (O'Dwyer, 2005). During this time, the federal government contributed an additional \$3 billion to support the development of educational technology.

In a study conducted by Quality Education Data, Inc. (QED, 2004), researchers estimated that during the 2003–2004 school year, approximately \$400 million was spent on software, with an additional \$220 million invested in the latest technological trend: wireless networks that supported portable wireless laptops and wireless-enabled handhelds.

The problems associated with technology's rising costs and with its integration into curricula are well-documented. The debate, however, continues as to whether the use of technology in education has been significantly more effective than traditional methods

of instruction. By 1998, there was little research available to determine if technology had decreased or increased student learning outcomes (Dusick, 1998).

In the 2000s, Congress mandated a federal study of the effectiveness of reading and math software as part of NCLB; the study was released in 2007 and indicated no significant differences in standardized test scores between students who used technology in their classrooms and those who used other learning methods. Researchers followed an experimental design drawn up with the help of leading education researchers and vetted by the U.S. Department of Education's Institute for Education Sciences (Dynarski et al., 2007). The study was conducted by Mathematica Policy Research, Inc., a research organization based in Princeton, New Jersey, and with assistance from SRI International, Inc., based in Menlo Park, California.

For the study, software products were selected in four categories: first-grade early reading, fourth-grade reading comprehension, sixth-grade prealgebra, and ninth-grade algebra. Because of the focus of the present study, the researcher examined the sixth-grade and ninth-grade results only, which addressed mathematics instruction. The programs used in the sixth grade were SmartMath (Davis, M., 2007), PLATO (Baker, W., Hale, T., & Gifford, B. 1997) Achieve Now (Chapman, E. 2000), and Larsen Prealgebra (Olson, L., 2005). In the ninth grade, Cognitive Tutor, PLATO Algebra, and Larsen Algebra were used. The technology-based curriculum packages were chosen from more than 160 products submitted in 2003 by the packages' developers. One criterion for selection was that the product had shown evidence of previous effectiveness.

The researchers' conclusion that there were no net test-score gains from using the software is sure to complicate the efforts of technology advocates. As Honey (2007) noted,

Proper implementation of education software is essential for success; unfortunately, it appears the study itself may not have adequately accounted for this key factor, leading to results that do not accurately represent the role and impact of technology in education. (p. 18)

The study's second main finding was that reading test scores for first graders were higher when teachers had fewer students and lower when teachers had more students. This finding concurs with the results of a STAR class-size experiment (Word et al., 1990) and of other class-size studies (e.g., SAGE in Wisconsin, Achilles, (1993).

Selected Comments From Proponents of

Computer Integration in the Classroom

Proponents of educational technology argue that when technology is used effectively in the classroom, technology investments lead to students' having more developed critical-thinking skills, stronger problem-solving skills, and higher order levels of understanding (Penuel, Yarnell, & Simkins, 2000; Salpeter, 2000). As one California state superintendent of schools noted in 1996,

Technology is an essential part of education as we approach the twenty-first century. Ninety percent of the jobs created from this moment on will require advanced technological training. To compete for these jobs, our children will have to be skilled in the use of information technology . . . If we allow our educational

system to fall behind the tide of change in the large world; we prepare kids for bit parts at best. As the marketplace changes, so do the skills that all students require. Today, the want ads for coal miners in Pennsylvania call for computer skills. (California State Department of Education, 1996 p. 23)

Some observers also reported that students enjoy classes and learn more in shorter periods of time when computer-based instruction is used (Kulik, 2000). According to a Rand report (1996), Gerstner, IBM's chief executive officer at the time, did not mince words when discussing the task facing American schools:

Before we get the education revolution rolling, we need to recognize that our public schools are low-tech institutions in a high-tech society. The same changes that have brought cataclysmic change to every facet of business can improve the way we teach students and teachers. And it can also improve the efficiency and effectiveness of how we run our Schools. (p. 9)

Additionally, Hawkins (2004) stated, "Our schools have only just begun to explore the potential of information and communication technologies. They lag far behind business in using tools like computers and the Internet in their daily work" (p. 7). Hawkins also stated that "it is increasingly clear that all students can benefit when technology is used intelligently to provide meaningful content and powerful tools for learning" (p. 10).

Kulik (as cited in Butzin, 2001) conducted one of the most comprehensive meta-analyses on CAI to date. Kulik aggregated data from more than 500 individual studies of computer-based education and concluded that students often learn more in less time when they receive CAI. It would appear that when used appropriately, CAI could facilitate

learning, thus creating more time for concept exploration and enrichment. In addition, CAI allows students to take control over their learning.

Kulik's findings were confirmed in a review of 12 meta-analytical studies showing that students who used a form of CAI scored in the 56th and 72nd percentiles, compared with students in noncomputer classrooms who scored in the 50th percentile (Smith, 2001).

Selected Comments From Critics or Skeptics of

Computer Integration in the Classroom

Critics of computer integration, however, argue that few studies of technology use meet rigorous empirical methodological standards or directly link the use of technology in the classroom with improved standardized test scores (Angrist & Lavy, 2002; Cuban, 2001). Stoll (1999) and Oppenheimer (2003) have criticized investments in education technologies by arguing that there is little evidence such technologies positively influence or impact teaching and learning. In 1996, President Clinton made \$2 billion available for 5-year grants through the Technology Literacy Challenge Fund. In addition, the president laid out the following four "pillars" (or goals) that he challenged the nation to achieve:

1. Modern computers and learning devices will be accessible to every student.

2. Classrooms will be connected to one another and to the outside world.

3. Educational software will be an integral part of the curriculum and as engaging as the best video

4. Teachers will be ready to use and teach with technology.

In 1999, the USDOE sponsored a conference in which teachers, parents, school boards, administrators,

governors, and members of Congress discussed whether the nation's investment in

technology was providing a return in student achievement. Indeed, if resources are to be expended on technology, it is becoming a political, economic, and public policy necessity to demonstrate technology's vital effectiveness (McNabb, Hawkes, & Rouk, 1999).

Today, with early warning testing and student achievement tests holding administrators, teachers, and students accountable, investments in technology are influencing teaching and learning; at the same time, standardized test scores remain the customary means for evaluating the benefits of educational innovations (McNabb et al., 1999).

Computer Integration and Standardized Test Scores

With the passage of NCLB legislation in 2002, testing has become not only routine but increasingly high-stakes and focused on specific content knowledge (Honey, 2005). Honey also reported that test results are regularly used as the measure for advancing students to the next grade, and as a gauge for judging the quality of schools and the educators who work in those schools.

Do standardized test scores truly measure a quality education, however? Some researchers and educators have suggested that standardized test scores may not be a valid measure of the effectiveness of using computers in the classroom. Additionally, standardized test scores are often not sensitive enough to measure the changes in learning that may occur when technology is used to develop specific skills or knowledge (O'Dwyer et al., 2005). When there are gains in standardized testing, it is difficult to discern whether the rise was because of the students' work with computers or because of other influences. These shortcomings of using standardized tests as the primary or only

outcome variable complicate efforts to examine the direct effects of technology use on student learning (O'Dwyer et al., 2005).

Types of Computer Integration

In 1985, Stennett observed that “well designed and implemented drill and practice or tutorial computer-assisted instruction, used as a supplement to traditional instruction, produces an educationally significant improvement in students’ final examination achievement” (p. 19). Stennett (1985) and Cuban (1993, 2001) have stated that although computers will never replace teachers in the classroom, they can be used to supplement instruction or to provide tutorials that enhance student performance and overall outcomes.

The single best supported finding in the research literature is that the use of CAI as a supplement to traditional, teacher-directed instruction produces achievement effects superior to those obtained through traditional instruction alone. Generally, this finding holds true for students of different ages and abilities, and for learning in different curricular areas (Cotton, 1991).

Overall research suggests that computers in the classroom should be used in conjunction with teacher-directed lessons and activities, and as a way to enhance students’ learning experiences. According to the EPE Research Center, (Kanaya, T., & Light, D., 2006) during the 2006–2007 school year, 17 states offered teachers incentives for using technology in the classroom. These incentives included credit for completing technology training, stipends, grants to finance technology projects in the classroom, salary increases, and hardware. Some states offered multiple incentives (*Manzo, K. K., 2007*).

Student Perspective

In 1987, Robertson et al. noted the following:

From the perspective of the student, computer assisted instruction has many benefits. Students “feel” computers are infinitely patient; never forget to correct or praise; are self-paced; do not embarrass students who make mistakes; give immediate feedback; are great motivators. (p. 80)

The Study Island program provided students with the above-cited benefits of CAI; it also protected students from the biases and impatience that some teachers might have toward a student, and it provided students with access to computers at home and throughout the school day.

Teacher Perspective

The use of technology in the classroom is at least partly reliant on the teacher’s knowledge and on the technical skills he/she possesses for integrating technology into a curriculum. Sivin-Kachala (1998) cited the results of 219 research studies and reported the following:

Students in technology-rich environments experienced positive influence on achievement in all major subject areas; students in technology-rich environments showed increased achievement in preschool through higher education in both regular and special education settings; students’ attitudes toward learning and their own self-concept improved consistently when computers were used for instruction. (p. 21)

Sivin-Kachala also noted, “The level of effectiveness of educational technology is influenced by specific student population, the software design, the educator’s role and the level of student access to the technology” (p. 93).

Furthermore, Schofield (1995) stated that, in order for teachers to use technology successfully in their classrooms, the following areas need to be addressed: 1. Computers must be made accessible in the classroom rather than only in computer labs. 2. Staff training must be offered each year to improve teachers’ ability to access and integrate the technology. 3. The software must be previewed and properly integrated with daily lessons. 4. Teachers must be able to relinquish control of the classroom and embrace the role of facilitator.

Finally, prior studies have suggested that many teachers attempting to use computer technology during instruction have difficulty adjusting to what may appear to be noisy, even disorderly, classrooms (p. 34).

Computer Treatment and Student Achievement

Kulik (1999) used meta-analysis to summarize findings from more than 500 individual research studies of computer-based instruction and concluded the following: On average, students who used computer-based instruction scored in the 64th percentile on achievement tests, whereas students who were instructed without the aid of computers scored in the 50th percentile; students learn more in less time when they receive computer-based instruction; students like their classes more and develop more positive attitudes when these classes include computer use; and student needs and instructional objectives are more easily met through computer-based instruction. To achieve the above

outcomes, Butzin (2001) and Mann (1999) emphasized that administrations must provide leadership to help guide teachers in the implementation of successful technology plans.

According to Dusick (1998), researchers have claimed that, compared with traditional classroom environments, technology use has the potential to improve instruction. For example, well-designed, computer-mediated instruction has been said to improve students' scores and attitudes toward learning, and to decrease learning time.

In addition, technology's benefits are not limited to instruction alone. As Massy and Zemsky (1995) noted, information technology allows for repeated access to large amounts of material at low costs.

In 1983, Clark claimed that media would never influence learning and argued that any advantage would be vulnerable to the following rival hypotheses:

1. The effects of content differences between instructional methods—with and without media—were not controlled, and therefore the medium was not necessarily the cause of any significant effect.
2. The novelty effect caused temporary improvements in learning.
3. It is the method of instruction, not the media, which fosters learning. (p. 25)

Dusick's (1998) views of educational technology were oppositional to Clark's, and Dusick rebutted Clark's concerns by referring to Kozma (1991), "who argues that media stand out through their cognitively relevant characteristics such as symbol systems and processing capabilities, thereby enabling students to process information more effectively, and understand it more fully" (p. 78). Furthermore, Bagui (1998) argued that, contrary to Clark's belief that media do not influence learning, engagement in guided discovery through multimedia increased student involvement, allowed for greater

understanding, and motivated students through the intrinsic features of the computer (e.g., immediate feedback, animation, and individualization).

In 1990, a professor at Stanford University developed a form of computer software called Integrated Learning Systems (Wilson, 1990). This software created drill-and-practice opportunities for students that provided instant feedback, and the software maintained student performance records for comparison. In evaluating the use of ILS, Wilson (1990) reported the following:

Of the sixteen studies conducted on I.L.S. in the area of mathematics, nine of the studies' test score superiority was determined to be statistically significant when trying to increase test scores by .38 deviations or from the 50th percentile to the 65th percentile. (p. 57)

Maine Laptop Learning Initiative

In 2002, the state of Maine purchased more than 36,000 Apple iBooks to accommodate the entire seventh- and eighth-grade population. Visitors to impacted schools could see a new kind of learning, in which students were given the authority to seek out information from a wealth of resources and to translate that information into forms beyond term papers or worksheets; for example, students could now produce video projects and Web pages. In addition, students could touch on multiple subjects (e.g., math, science, history) in one project. Allowing each student to have his or her own laptop throughout the day made technology use second nature. Principals reported that students showed great responsibility in taking care of the laptops, and there were few reports of loss or damage (Curtis, 2004).

The initiative also produced many positive results for staff members. Teachers found that contact time and communication improved drastically as students and teachers e-mailed each other before and after school. These teachers also noticed a drastic increase in writing ability as students wrote more and more skillfully. In fact, the program eliminated the stereotypes often used to generalize about the way boys and girls write (Curtis, 2004).

According to Curtis, students enjoyed the efficiency of having computers at the ready, rather than having to schedule computer use in a school lab. Students were no longer limited to using textbooks and paper; they now had instant access to e-mail for asking teachers questions. According to Harvard University education professor Dede (2005), students became more interested in school; as a result, “researchers have developed a theory on how students can engage with academic subjects through what [Dede] prefers to call computerized simulations” (*McCulloch, M.*, 2005, p. 19).

A study by Silvernail and Gritter (2004) was the first in a series aiming to evaluate the impact on student achievement and learning of Maine’s first-in-the-nation laptop program. (As stated above, the laptop program, which sought to eliminate the “digital divide” between poor and wealthy students, provided seventh and eighth graders with more than 30,000 computers in 2002 and 2003.) Silvernail and Gritter’s study focused on determining if eighth graders’ scores on the Maine Educational Assessment supported teachers’ and students’ perceptions that laptop use promoted better writing skills. (Next year, the researchers plan to release a study on how laptop use has impacted math instruction.)

According to Silvernail and Gritter (2005), the Maine Education Assessment scores revealed that 49% of eighth graders were proficient in writing in 2005, compared with 29% percent in 2000, indicating a score increase of 20% over a 5-year span. State Commissioner of Education Sue Gendron stated, "This represents the first concrete evidence backing up what most educators already feel: The laptop program, known as the Maine Learning Technology Initiative, is working" (Cavanagh, 2007, p 11).

Does Integrating Computers Into Curricula Improve Achievement?

One of the largest and most extensive analyses to date on computers and their influence on academic achievement was conducted by Wenglinsky (1998) in conjunction with Educational Testing Service (ETS). For the study, the 1996 NAEP was used to obtain a sample of 6,227 fourth graders and 7,146 eighth graders. (The NAEP includes information on educational technology, including self-reported frequency of computer use for mathematics instruction; access to computers and frequency of computer use at home; professional development of mathematics teachers in computer use; and kinds of instructional uses of computers by mathematics teachers and their students. Wenglinsky's (1998) findings for the eighth graders included the following: Teachers' professional development in technology and the use of computers to teach higher order thinking skills were both positively related to academic achievement and mathematics and the social environment of the school; the frequency of home computer use was positively related to academic achievement and the social environment of the school; the use of computers to teach lower order thinking skills was negatively related to academic achievement and the social environment of the school; the frequency of school computer use was unrelated to

the social environment of the school and negatively related to academic achievement. (p. 73).

According to Wenglinsky (1998), the relationship between the various positive uses of technology and academic achievement was substantial for eighth graders. For this group of students, professional development and computer use for higher order thinking skills were each associated with grade-level increases of more than one third. As Wenglinsky noted,

All of this suggests that computers are neither cure-alls for the problems facing schools, nor mere fads that have no impact on student learning. Rather, when they are properly used, computers may serve as important tools for improving student proficiency in mathematics, as well as the overall learning environment in the school. (p. 73)

Laptop Immersion Program

In 2001, educators at Harvest Park Middle School in Pleasanton, California, established a Laptop Immersion Program. Regarding the program, Guleck and Demirtas (2005) reported,

As a school experiencing rapid growth over a short period of time, the challenge of Harvest Park was to maintain the same high level of academic excellence, while building an infrastructure that would meet the demands of its student population. (p. 33)

The laptop program emerged from a partnership between the community's high-tech businesses and the school, which was searching for innovative programs (Gulek & Demirtas, 2005). The authors continued by stating,

Students participated in a computer camp to become comfortable with the laptop by learning about its many capabilities. Once completed, students then began to use the laptop on a daily basis in the classroom. By 2003–2004, of the 1085 students enrolled in the school, 259 were participating in the Laptop Immersion Program. (p. 11)

The following data were collected for participating and nonparticipating students: GPAs, end-of-course grades, district writing assessment results, standardized norm-referenced test results, and California standards test results (Gulek & Demirtas, 2005).

The researchers concluded that the Laptop Immersion Program was productive. Analyses of outcome measures collected after students participated in the program indicated that students who participated tended to earn significantly higher test scores and grades for writing, English-language arts, and mathematics, and they had higher overall GPAs (Gulek & Demirtas, 2005).

Conclusion

The problem of determining the effectiveness of integrating computers into curricula is well-documented in the literature. In addition to the pressures brought on by NCLB, more funds are being spent on the latest equipment and technologies; as a result, districts and legislatures will be seeking more definitive answers to questions surrounding the impact of computer integration on student achievement. Also, increasingly sophisticated studies will continue to erode limitations, and there will likely be further attempts by technology proponents and critics alike to clarify the influence of computers in the classroom.

The results of the research literature and review contribute to the significance of the current study, which in turn attempts to continue the conversation about technology's effectiveness in the classroom. Effective technology use must be supported by significant investments in hardware, software, infrastructure, professional development, and support services. The United States has invested more than \$66 billion in school technology over the past decade (QED, 2004). This unprecedented level of investment in educational technology has raised expectations, and legislators and the public are now seeking returns on this investment. They are calling for evidence—especially experimental, empirical evidence—to support claims about the efficacy and cost-effectiveness of using technology in K–12 schools (Melmed, 1995).

The literature addressed in this review presents a sampling of arguments presented by proponents for and critics of education's investment in technology. Proponents claim that students benefit from exposure to technology, even if those benefits are not always measurable. Critics identify the economic impact on districts and want verification that higher learning outcomes are being achieved.

In summary, chapter II has provided a review of selected research and literature, and a historical look at the integration of technology in American education systems. Chapter III presents the design and methodology that were used to determine the effect the specific chosen technology had on standardized test mathematics scores.

Chapter III

DESIGN AND METHODOLOGY

Introduction

This chapter describes the design and the methodology the researcher followed to conduct the present study, including research questions; it also discusses the instrumentation used to collect student data. More specifically, this chapter outlines the research design, the various components and methods of data collection, a discussion of treatment and nontreatment group methodologies, and analysis procedures. The first section describes the population studied and documents the procedures used to obtain the two random-assignment samples that comprised the treatment and control groups.

The purpose for this study was to analyze the achievement of eighth-grade students who used the computer-based Study Island mathematics program by comparing a representative population of average and above-average students divided randomly into experimental and control groups. Students in both groups received instruction in a traditional classroom setting, and both were instructed using a prealgebra textbook; the only difference was that students in the experimental group received some instruction through the Study Island program, and those in the control group did not. Two research questions guided the inquiry on variance in scores obtained from the treatment and control groups on the Grade 8 Proficiency Assessment (GEPA).

Description of Sample

In this study, the researcher examined computer integration in mathematics through the administration of a technology treatment. This treatment was used in conjunction with 2005 GEPA scores obtained from 240 middle-school students in Ocean County, New Jersey. A randomly selected treatment group of 120 students and a randomly selected nontreatment group of 120 students were selected out of a student body of 400 eighth-grade students. The delimitation was that special education and honors students were excluded from the study, and only those immersed in the school's prealgebra curriculum were included. Those students selected for the technology treatment had the number *one* placed next to their names, whereas those in the nontreatment group were assigned the number *zero*. The 120 students in the treatment group were placed in one of six classes offered; the average class size was 20 students.

Minority students accounted for 5% of the total student population, 2% were classified as ESL students, and 21% were eligible to receive free and reduced lunches. Approximately 20% of the students were enrolled in special education classes, whereas 3% were enrolled in the school's honors program. The rest of the students (here classified as the general population) represented approximately 48% of the total middle-school population.

The researcher primarily used quantitative data collected from students' scores on the math section of the 2005 GEPA, student GPAs, attendance records, and technology treatment results; student information was obtained from the Central Regional School District database. Students in the Study Island program (treatment) group were coded using the number *one*, and students in the nontreatment group were coded using the

number *zero*. At the time of the study, both groups were working through prealgebra curriculum. The researcher coded student attendance as follows: Students who were absent for 1–5 days were coded using the number *zero*; those absent for 6–10 were coded using the number *one*; those absent for 11–15 days were coded using the number *two*, and students who were absent for 16 or more days were coded using the number *three* (see Table 2).

Table 1

Coding of the Key Variables of the Study

Key Variable	Code
Technology Treatment	
Participant	1
Nonparticipant	0
Attendance	
1–5 Days Absent	0
6–10 Days Absent	1
11–15 Days Absent	2
16 or More Days Absent	3

The data were collected during the 2004–2005 school year. Special education students who had Individualized Educational Plans (IEPs) that did not allow them to participate in general education mathematics (prealgebra) and students who were enrolled in the honors program (algebra) were excluded from the population before the samples were drawn. The computer was then programmed to randomly select students using prime numbers at first, then alternating and selecting every sixth student from the population until 120 students were drawn for each group. The guidance counselor then checked each group to ensure that the population met all parameters in that no student

was enrolled in the honors program or special education courses and in that all selected students were exposed to the prealgebra curriculum. The counselor then attached GEPA scores and attendance records for the selected students and presented the data to the researcher for use during the experiment.

Once the parameters were set, the following data were collected from the 120 students in the treatment group: scores from the math section of the 2005 GEPA, GPAs, attendance records, and technology treatment information retrieved from the Central Regional School District database from a pool of a possible 200 students who received the mathematic treatment. Next, 120 students out of a possible 200 were randomly selected for the nontreatment group, and similar data were obtained. Both sets of data were merged onto one Microsoft Excel spreadsheet.

Finally, the information was exported to a Statistical Package for Social Studies (SPSS) database, where it could be analyzed using the aforementioned statistical tools.

Sampling, Instrumentation, and Validity

As part of New Jersey's annual testing program, every eighth-grade student was assessed using the GEPA during the 2004–2005 school year; the assessment provides scale scores in mathematics, language arts, and science.

The present study was conducted in a district assigned a DFG B. (As stated above, the DFG is used by the NJDOE to classify schools according to socioeconomic status [SES].)

As reported in the *New Jersey Department of Education Handbook for Report Interpretation for the GEPA*, (2005) the major validity interest focuses on traditional “content validity” considerations; furthermore, “the content validity of these assessments

has its foundation in the judgments of New Jersey content experts” (p. 53). These content experts are generally teachers and curriculum experts from demographically diverse and geographically balanced school districts across New Jersey.

Additionally, according to the handbook,

These content area experts construct item specifications (and in the case of reading, selected passages), write items (or in the case of writing, develop prompts), develop scoring rubrics, and determine the proportion of items to be assessed in each academic standard by grade level. (p. 53)

These committees of experts also review the results of field-test data, including examples of actual student written work, to determine an item’s suitability for possible inclusion on the GEPA.

On the 2005 GEPA, students’ scores were based on the number of items students answered correctly relative to the total number of test items that appeared on the reading and mathematics sections of the assessment. More specifically, 70 multiple-choice and 3 open-ended items comprised the total score at each grade level.

Table 3 lists the internal consistency estimate of reliability (Cronbach’s coefficient alpha) for mathematics at Grade 8 (NJDOE, 2005).

Table 2

Internal Reliability Coefficients for the 2005 Math GRPS

Subject	Grade 8
Mathematics	0.93

Because the researcher's intent was to explain any differences, effects, patterns, or relationships in the data, the researcher chose to rely on inferential methods. The significance of analyses were based on the level of significance $p < .05$, which is common in social research. In this study the researcher examined the disaggregated test scores of those eighth-grade students who participated in the technology treatment and a sample of those students who did not participate. Using the level of significance $p < .05$, the researcher attempted to ensure a sufficient power of 0.95. The number of treatment levels, where $K = 2$, and sample size per treatment levels were compared with differences detected between treatment levels ($C\sigma$) of $.5\sigma$; a minimum sample size of 62 was required. The researcher used the SPSS version 12.0 to determine the minimum sample size for Groups 1 and 0.

Analyses

After all data were secured, statistical analyses were conducted using the SPSS 12.0. Each research question and accompanying method of analysis is reiterated below.

Research Questions

Question 1. What influence does the 44-minute weekly technology treatment have on students' mathematical achievement on the GEPA?

Question 2. How do the main effects of GPA after the third marking period, student attendance, and involvement in a technology treatment impact GEPA score differences between those in the treatment group (1) and those in the nontreatment group (0) when one controls for curriculum?

To address the first question, the researcher used a simple t test to examine the means between the two groups. The dependent variable was the mean of student scores from the mathematics portion of the GEPA. Although one independent variable consisted of the 120 randomly selected students who did not receive the technology treatment (Group 0), the other independent variable consisted of the 120 randomly selected students who did receive the technology treatment (Group 1) while Group 0 went to physical education class.

To address the second question, the researcher used a hierarchical linear regression analysis and an analysis of covariance (ANCOVA) to determine the relationship between math GEPA scores and intersections between the technology treatment and student GPAs while applying statistical control to the curriculum. Another ANCOVA was run to determine the relationship between math GEPA scores and any interaction effects between the technology treatment and attendance while applying statistical control to the curriculum. A third ANCOVA was run to determine the relationship between math GEPA scores and any interaction effects between students' GEPA scores, attendance records, and GPAs while applying statistical control to the curriculum. In this study, the primary independent variables were involvement in the technology treatment, GPA, and attendance. The covariate was curriculum, and the dependent variable was GEPA math scores. The use of this statistical treatment afforded the researcher the opportunity to test the null hypotheses and answer the research questions. Data collected in this study were statistically analyzed utilizing SPSS software and coded as in Table 4 (see below).

Table 3

Research Design Analysis

Research Question	Independent Variable	Dependent	Measurement
What influence does the 44-minute weekly technology treatment have on students' mathematical achievement on the GEPA?	Technology Treatment	GEPA Mathematics	Mean Scale Score
How do the main effects of GPA after the third marking period, student attendance, and involvement in Study Island impact GEPA score differences between the treatment group (1) and the nontreatment, or control group (0)?	Technology Treatment GPA Attendance	GEPA Mathematics	Mean Scale Score

The pertinent statistical method used to examine each of the null hypotheses is stated below. The significance of each hypothesis was determined at the .05 probability level, which is standard for social research.

Ho 1. No difference exists between the GEPA math scores of students who received the technology treatment and the scores of students who did not.

Ho 2. When the researcher controls curriculum based on eighth-grade mathematics GPAs, attendance, and involvement in the technology treatment, no

difference exists between the GEPA math scores of students in the treatment group and the scores of those in the nontreatment group.

Treatment

The treatment was the use of the Study Island program and its influence on student achievement as reflected by standardized mathematics test scores. Students in the treatment group used the Study Island program in 44-minute weekly sessions over a 15-week period. The students were removed from physical education classes 1 day a week to receive the treatment. Meanwhile, students in the nontreatment group remained in physical education classes all 5 days of the school week. The intent was for each student to work one-on-one in a safe computer environment. All students in both groups were engaged in the prealgebra curriculum.

Data Analysis Methods

Understanding that students differ in achievement and knowledge levels for various reasons (e.g., SES, IQ, work ethic) implies recognizing the hierarchical nature of the data. If the composition between the two groups differed, a substantial but unmeasured effect of that composition on achievement gain could either provide a real treatment influence or make negligible influence look falsely significant. Bobbett, French, and Achilles (1993) “found that the statistical analysis selected to examine the impact of predictor variables on the dependent variable can have a large impact on the findings of a study” (p. 46).

Quantitative Data Collected

The quantitative method of this study included four data collection components, as shown in Table 5.

Table 4

Data Collection Components, Comparative GEPA Study, 2004–2005

Type of Data	Collection	Time
1 Student GEPA Scores	Treatment GEPA Scores	June 2005
2 Student GEPA Scores	Nontreatment GEPA Scores	June 2005
3 Student Report Cards	Grade Point Average	June 2005
4 Student Attendance Record	Attendance	June 2005

The data were collected via the Central Regional School District database after gaining approval from the superintendent of schools. Once the researcher obtained permission, the guidance counselor submitted data to the researcher for analysis.

Summary

Chapter III has presented the methodology and research design for this study, as well as reasons for using this design. Additionally, the treatment group and the nontreatment group were identified and outlined in detail, data analysis methods were delineated, and the six data collection components were discussed. Chapter IV presents the data, results of data analyses, and pertinent tables.

Chapter IV

ANALYSIS OF DATA AND PRESENTATION OF FINDINGS

The researcher used an independent t test to compare the mean GEPA math scores of those students given the technology treatment with the scores of students who did not receive this treatment. The dependent variable (outcome) was the mean of GEPA mathematic scores, whereas the independent variable was the technology treatment.

The mean score for those students receiving the Study Island treatment was 242.82, compared with a mean score of 206.58 for students who did not receive the treatment. Levene's Test for Equality of Variances yielded statistically significant results, with $F = 14.553$ and $p = .000$. This significance required the use of equal variances not assumed in the lower entries of Table 6. The resulting t value was 10.342, and $p = .000$. Results indicated that the technology treatment (Study Island program) had a significant influence on students' GEPA mathematics scores. These mean scores were out of a possible score of 300 on the GEPA exam (see Tables 7 and 7A). The effect size per Cohen's guidelines is $t^2 / t^2 + df$ or $106.96 / 106.96 + 210.82 = 0.34$ or larger (Witte & Witte, p. 377)

Table 5

T-Test (Treatment vs. Nontreatment Group)

Group Statistics					
GROUP		N	Mean	Std. Deviation	Std. Error Mean
GEPA	Treatment	120	242.82	21.725	1.983
	Nontreatment	120	206.58	31.636	2.888

Additionally, the researcher used a one-sample *t* test to compare the mean GEPA math scores of those students given the technology treatment with the mean scores of students from DFG B. This analysis was performed to determine how the scores of students receiving the treatment compared to those in students of the lower SES groups. The mean score for those students receiving the Study Island treatment was 242.82, compared with the state DFG B mean score of 206.4. In the one-sample *t* test, the *t* value of the treatment group was 18.363. These results indicated statistically significant differences, with $p = .000$. The same statistical analysis was completed for those students in the nontreatment group. The mean score for these students was 206.58, compared with the state DFG B mean score of 206.4. This analysis was performed to see how students in the nontreatment group compared to students one of the lower SES groups. This resulted in a nontreatment group *t* value of 0.063. No statistical significance was found in this comparison, with $p = .949$ (see Tables 7 and 8).

Table 6

T-test Mean Scores

		Independent Samples Test					
		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
GEPA	Equal variances assumed	14.553	.000	10.342	238	.000	36.233
	Equal variances not assumed			10.342	210.818	.000	36.233
							Std. Error Difference
							3.503
							3.503

Table 7

Treatment Group vs. DFG B

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
GEPA	120	242.82	21.725	1.983

One-Sample Test				
	Test Value = 206.4			
	t	df	Sig. (2-tailed)	Mean Difference
GEPA	18.362	119	.000	36.417

Table 8

Nontreatment Group vs. DFG B

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
GEPA	120	206.58	31.636	2.888

One-Sample Test				
	Test Value = 206.4			
	t	df	Sig. (2-tailed)	Mean Difference
GEPA	.063	119	.949	.183

Further, the researcher extended the one-sample t test to compare the mean GEPA math scores of those students given the technology treatment with the mean scores of students from DFG J. This analysis was performed to see how the scores of students

receiving the treatment compared to students' scores in one of the higher SES groups. The mean score for students receiving the Study Island treatment was 242.82, compared with the state DFG J mean score of 236.8. In the one-sample t test, the t value of the treatment group was 3.034. These results indicated statistically significant differences, with $p = .003$. The same statistical analysis was completed for those students in the nontreatment group. The mean was 206.58, compared with the state DFG J mean score of 236.8. This analysis was performed to see how the students' scores in the nontreatment group compared to students' scores in one of the higher SES groups. The t value for the nontreatment group was -10.463, which indicated statistical significance, with $p = .000$ (see Tables 7 and 8).

Table 9

Treatment Group vs. DFG J

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
GEPA	120	242.82	21.725	1.983

One-Sample Test

	Test Value = 236.8			
	t	df	Sig. (2-tailed)	Mean Difference
GEPA	3.034	119	.003	6.017

Table 10

Nontreatment Group vs. DFG J

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
GEPA	120	206.58	31.636	2.888

One-Sample Test

	Test Value = 236.8			
	t	df	Sig. (2-tailed)	Mean Difference
GEPA	-10.463	119	.000	-30.217

By comparing the means of the treatment and nontreatment groups with two ends of the SES spectrum, the researcher discovered that students in the treatment group outperformed students in the DFG B and J groups. Students' mean scores in the nontreatment group were consistent with mean scores in the lower SES group and were lower compared to higher SES mean scores.

As noted, the NJDOE developed the DFGs as a mechanism to account for SES when comparing similar districts' performance on statewide assessments. A reasonable expectation is that the average student performance on such assessments would increase from DFG A to DFG J. Table 11 shows the average score for each section of the Elementary School Proficiency Assessment (ESPA), Grade 8 Proficiency Assessment (GEPA), and the High School Proficiency Assessment (HSPA) administered during the 2005–2006 school year. Without exception, the average student performance steadily increased from DFG A districts to DFG J districts.

Table 11

Average Statewide Assessment Score by 2005 DFG

DFG	ESPA		GEPA			HSPA	
	Lang Arts	<u>Math</u>	Lang Arts	<u>Math</u>	Science	Lang Arts	<u>Math</u>
A Low	208.9	199.4	201.0	191.3	201.4	209.9	197.4
B	214.1	210.3	213.4	206.4	217.4	221.0	212.3
CD	218.3	219.0	217.2	208.7	224.0	224.7	216.2
DE	221.8	224.8	221.9	214.6	228.6	228.3	220.5
FG	224.1	229.3	224.9	220.5	232.3	230.9	226.2
GH	226.1	233.4	227.8	225.7	235.2	234.6	231.2
I	230.6	240.4	233.4	231.8	240.1	240.1	239.6
J High	233.8	247.1	238.5	238.6	244.0	244.1	244.8

After examining mean scores, the researcher used a regression model, as there were at least two independent variables (predictors). The dependent variable (outcome) was the mean of GEPA mathematics scores. The independent variables (predictors) were involvement in the technology treatment, student GPAs, and student attendance.

Table 12

Variables Entered and Removed

Model	Variables Entered	Variables Removed	Method
1	Technology GPA Attendance		Entered

- All requested variables entered
- Dependent GEPA math scores

Model 1 was significant, with a p value (sig) < .000 and an F value of 23.968.

Model 2 was also significant, with a p value (sig) < .000 and an F value of 51.99. Finally,

Model 3 was significant, with a p value (sig) < .000 and an F value of 36.844.

In terms of which predictors were significant, in Model 1, the R^2 value for the technology treatment was 0.072, which meant that approximately 7.2% of the variance in GEPA math scores could be explained by the technology treatment. Therefore, the technology treatment as a predictor was significant, with a p value \leq .000, a t value of 4.896, and a standardized beta of 0.269. The beta was positive, which indicated that the students who received the technology treatment (1) were predicted to perform better on the math section of the GEPA than students who did not receive the treatment (0).

Table 13

Model Summary

Model 1	R^2	p Value
Technology	0.072	.000
Model 2 Technology/GPA	0.253	.000
Model 3 Technology/GPA/Attendance	0.266	.023

In Model 2, the R^2 value for the technology treatment and students' GPAs was 0.253, which meant that approximately 25.3% of the variance in GEPA math scores could be explained by both the technology treatment and students' GPAs. The R^2 change value for this model was 0.181, which meant that the addition of GPA as a predictor accounted for an additional 18.1% of the approximate variance in GEPA math scores; this calculation made the total variance explained 25.3%. This change was significant, as

indicated by a p value $< .000$ in Model 2. The technology treatment as a predictor was also significant, with a p value $< .000$, a t value of 3.890, and a standardized beta of 0.195. The beta was positive, which indicated that students who received the technology treatment (1) were predicted to perform better on the math section of the GEPA than students who did not receive the technology treatment (0).

Also in Model 2, student GPA as a predictor was significant, with a p value $< .000$, a t value of 8.612, and a standardized beta of 0.432. The beta positively indicated that students with higher GPAs performed better on the math section of the GEPA than students with lower GPAs did.

Model 2 also showed that the beta for GPA (0.432) was larger than the beta for the technology treatment (0.195), which suggests that GPA is a stronger predictor of GEPA math scores than participation in the technology treatment is. Also, the addition of GPA as a predictor caused the standardized beta for the technology treatment to decrease from 0.269 to 0.195.

Table 14

Coefficients

	Standard Beta	p Value	t Value
Model 1			
Tech	0.269	.000	4.896
Model 2			
Tech	0.195	.000	3.890
GPA	0.432	.000	8.612
Model 3			
Tech	0.176	.001	3.480
GPA	0.428	.000	8.598
Attendance	-0.0114	.023	-2.291

In Model 3, the R^2 value for involvement in the technology treatment, students' GPAs, and attendance records was 0.266, which meant that approximately 26.6% of the variance in GEPA math scores could be explained by this combination of predictors. The R^2 change value for this model was 0.013, which meant that the addition of attendance as a predictor accounted for an additional 1.3% of the variance in GEPA math scores; this calculation made the total variance explained approximately 26.6%. This change was significant, as indicated by a p value $< .023$.

Participation in the technology treatment as a predictor was significant, with a p value $< .001$, a t value of 3.480, and a standardized beta of 0.176. The beta was positive, which indicated that students who received the technology treatment (1) were predicted to perform better on the math section of the GEPA than students who did not receive the technology treatment (0).

In Model 3, GPA as a predictor was also significant, with a p value $< .000$, a t value of 8.598, and a standardized beta of 0.428. The beta was positive, indicating that students with higher GPAs performed better on the math section of the GEPA than students with lower GPAs did. Model 3 also shows that attendance as a predictor was significant, with a p value $< .023$, a t value of -2.291, and a standardized beta of -0.0114. The beta was negative, which suggests that students with low absentee rates were predicted to perform better on the math section of the GEPA than students with high absentee rates.

In Model 3, the beta for GPA (0.428) was larger than the beta for involvement in the technology treatment (0.176) and attendance (-0.114); this suggests that GPA is a

stronger predictor of GEPA math scores than the technology treatment and attendance rates. Likewise, participation in the technology treatment (0.176) is a stronger predictor of GEPA math scores than attendance is (-0.114). The addition of attendance as a predictor caused the standardized beta for the technology treatment to decrease from 0.195 to 0.176, and the beta for GPA to decrease from 0.0435 to 0.428.

The model having an R^2 change that is significant and accounts for the most variance in GEPA math scores is best to use for the current study. Model 3 accounts for the most explained variance of 26.6% and has an R^2 change that was significant.

The implications are that the Study Island program had a significant influence on standardized test scores in mathematics. Further research is required to confirm findings and to implement the Study Island program in schools.

The data helped the researcher determine the influence of a technology treatment on standardized test scores for the mathematics portion of the GEPA. These data also provided the opportunity to compare and analyze mean scores and, and they were the foundation of this dissertation.

Table 15

Data Gathered

TREATMENT GROUP				NONTREATMENT GROUP			
GPA	GEPA	ABSENTS	M/F	GPA	GEPA	ABSENTS	M/F
88	251	1	0	83	200	1	1
88	274	0	1	85	178	1	0
85	200	1	0	91	274	0	1
88	257	1	0	77	180	1	1
92	213	1	1	80	172	2	1

Table 15, Continued

TREATMENT GROUP				NONTREATMENT GROUP			
GPA	GEPA	ABSENTS	M/F	GPA	GEPA	ABSENTS	M/F
91	240	2	0	92	264	1	0
79	257	2	1	85	199	0	0
80	225	1	1	88	191	0	0
95	259	1	1	88	281	0	1
88	235	1	1	79	168	1	0
95	263	1	0	91	189	1	1
77	231	2	1	79	180	0	1
85	259	3	0	80	187	0	1
92	238	0	0	84	167	0	0
84	237	2	1	86	200	0	0
85	203	0	0	82	163	1	0
79	276	1	0	86	220	1	1
89	259	1	1	92	200	1	0
79	225	2	1	93	206	2	0
90	233	1	1	95	274	1	1
90	269	0	0	89	220	0	1
92	257	0	0	88	215	1	0
95	261	1	1	90	210	1	0
76	272	1	1	81	190	0	0
93	247	0	0	84	166	1	1
89	216	1	0	90	202	1	0
77	250	2	0	93	270	0	1
86	257	0	0	72	170	2	1
79	238	2	1	87	244	0	1
89	240	2	1	95	238	1	1
83	227	2	0	78	200	0	1
97	261	1	0	82	240	1	0
76	245	0	1	85	225	0	1
66	227	1	1	79	163	1	0
91	220	1	0	88	213	1	0
71	220	2	1	90	256	2	1
84	240	0	0	91	246	0	0
96	274	0	1	92	283	0	1
96	242	1	0	86	176	1	0
81	201	2	0	89	178	1	1
92	272	1	1	96	250	0	0
97	263	0	0	83	179	1	1

Table 15, Continued

TREATMENT GROUP				NONTREATMENT GROUP			
GPA	GEPA	ABSENTS	M/F	GPA	GEPA	ABSENTS	M/F
85	238	1	0	76	199	1	1
91	245	0	0	86	190	0	1
96	263	0	1	81	191	0	1
86	250	0	1	77	152	1	1
93	274	0	0	82	186	0	0
91	259	1	1	85	203	0	1
90	263	0	1	88	199	0	0
83	250	2	1	90	242	0	0
71	267	0	1	81	197	2	0
78	233	1	1	90	215	0	1
97	257	1	0	92	206	0	1
80	229	0	0	88	187	1	0
87	231	1	0	89	206	0	0
85	237	1	1	90	227	1	1
80	253	1	1	81	163	0	1
79	203	1	1	83	190	0	1
91	261	1	0	84	167	1	0
91	257	0	0	87	182	0	0
92	250	0	1	83	196	3	0
85	269	0	0	91	171	1	1
78	261	1	1	80	205	0	1
73	242	3	1	87	178	2	0
89	233	1	1	80	187	1	0
93	238	3	1	93	186	0	0
95	245	1	0	90	193	1	0
74	261	2	1	86	197	0	1
80	242	1	0	88	167	1	0
96	213	0	0	79	200	0	1
80	257	2	1	75	189	1	1
92	251	0	1	80	172	0	1
73	233	1	0	87	213	0	1
76	261	3	1	89	205	1	1
86	257	1	1	80	203	0	0
87	242	0	0	92	215	1	0
89	272	1	1	91	167	0	0
97	240	0	0	93	187	0	0
88	225	2	0	84	174	0	0

Table 15, Continued

TREATMENT GROUP				NONTREATMENT GROUP			
				GPA	GEPA	ABSENTS	M/F
GPA	GEPA	ABSENTS	M/F	NON	NON	NON	NON
77	261	1	0	88	242	1	1
87	220	0	1	87	205	0	1
84	216	0	1	89	213	1	1
93	238	0	0	85	194	1	0
79	245	0	1	83	174	0	1
93	269	1	0	90	162	0	1
88	218	0	1	86	220	0	0
82	237	0	0	88	191	2	0
86	257	1	1	90	246	1	1
98	265	1	1	91	215	0	0
92	257	0	1	78	160	1	1
81	242	1	1	92	262	0	1
91	242	0	0	85	220	0	1
92	191	0	0	89	190	1	0
93	229	0	0	90	208	1	0
80	206	2	1	86	238	0	1
94	213	1	0	82	202	0	1
81	166	0	0	97	274	0	0
89	250	0	1	95	202	0	0
73	221	1	1	98	191	1	0
73	269	2	0	88	165	0	0
69	259	3	1	82	218	0	1
75	203	2	0	88	215	0	0
94	221	0	1	84	274	0	1
87	233	1	1	80	178	0	1
86	220	2	0	83	202	0	1
82	200	1	0	85	221	0	0
86	218	0	1	88	161	0	0
99	257	0	0	90	218	0	0
79	247	1	0	87	234	0	0
92	255	0	1	93	250	1	0
93	255	0	1	91	250	0	1
84	240	1	1	93	258	0	1
90	276	1	0	85	236	2	0
88	269	0	0	93	231	1	0
89	223	1	0	95	258	1	0
93	211	0	0	97	250	1	0

Table 15, Continued

TREATMENT GROUP				NONTREATMENT GROUP			
				GPA	GEPA	ABSENTS	M/F
GPA	GEPA	ABSENTS	M/F	NON	NON	NON	NON
92	227	2	0	85	227	0	1
94	278	1	1	88	162	1	1
96	267	1	1	90	216	0	0
93	271	0	0	91	223	0	1

Summary

In this chapter, the researcher examined the influence of the Study Island program on standardized testing. The researcher analyzed the influence of a mathematical technology program (treatment) on student achievement for 120 randomly selected eighth-grade students, compared with 120 nontreated, randomly selected eighth-grade students. The students participating in this study were delimited to those not enrolled in special education or honors programs, and all chosen participants were engaged in a prealgebra curriculum.

The researcher also excluded an examination of gender from the current study; however, the further research and discussion sections of Chapter V pose the question of whether male students outperformed female students in this study or vice versa. In the next chapter, the researcher provides a summary of the findings, conclusion, discussion, and recommendations for future research, policy, and practice.

Chapter V

SUMMARY OF FINDINGS, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS FOR POLICY PRACTICE AND FURTHER RESEARCH

Introduction and Review of Purpose

This chapter presents a summary of the findings, conclusions, and recommendations for future research, policies, and mathematics teaching practices. Data analysis and pertinent conclusions were presented in Chapter IV.

The purpose of this study was to compare and analyze standardized test scores to determine the influence a technology treatment had on these scores. Students in the treatment group ($n = 120$) were exposed to the Study Island program, whereas students in the nontreatment group ($n = 120$) were not. Class sizes for both groups were equal, with an average of 21 students per class. McKinsey and Company (2001) estimated that in 1995, approximately \$3.3 billion was spent on hardware, software, networking, and related technology costs. By 1998–1999, spending had increased to \$5.5 billion, or \$119 per child (Cuban, 2001, p. 1).

This cost increase justifies this study because the study's results could guide school district leaders in making financial and educational decisions for their students' academic futures. Both Niemic and Walberg (as cited in Waxman, Connett, & Gray, 2002) and Christmann and Badgett (1997) demonstrated that technology use had a positive, significant effect on student learning. There is conflicting evidence in the

research, however, regarding effective ways to use technology during the learning process.

Wenglinsky (1998) reported that when technology is used for drills and practice, students lose grade-level growth. Keodinger, Alibali, and Nathan (1999) claimed, however, that students succeed when technology is used to assist students in developmental mathematics, as this technology can provide students with grounded representations of abstract ideas using story problems in a digital environment.

Summary of Research Methods

The researcher placed all of the data in a Microsoft Excel spreadsheet and imported those data to an SPSS 12.0 database. Once the data were organized, each of the two research questions was addressed using GEPA scale score means and corresponding independent variables. A *t* test and regression model were chosen to create the appropriate statistical treatment, as the researcher was trying to determine if any or all aspects of computer integration in the classroom were significant predictors of (or had a significant influence over) student achievement on the GEPA. The researcher then analyzed the data obtained to respond to each research question.

Review of Findings and Interpretations for Achievement Conclusions

The results indicate that students who received the technology treatment outscored students who did not receive the treatment and that the treatment had a significant impact on standardized test scores. Related research in the field also revealed that home computer use increases the likelihood that children will graduate from high school; however, Blacks and Latinos are much less likely to have computers in their

homes than Whites are, according to a report by Fairlie (2005), a researcher at the University of California, Santa Cruz (UCSC). Fairlie noted that, “Although many studies have explored the impact of computers in schools, and the federal government has made computer access in schools a priority, few studies have assessed the impact on youth of having a computer in the home” (p. 75). A key finding in Fairlie’s research was that teenagers who had access to home computers were 6–8% more likely to graduate from high school than were teens who lacked access to home computers, after reportedly controlling for individual, parental, and family characteristics.

Recommendations for Practice and Policy

The ability to create new academic opportunities for students not only in the classroom but at home is the new trend in education. As a part of this trend, the role that technology has played in curricula since the 1990s is changing. Early digitized curricula simply automated textbook drill-and-practice exercises. Evidence from the Study Island program, however, suggests that students can become independent learners using a technology treatment; in the current study, this was seen in middle-school prealgebra learners. Therefore, the researcher recommends that the Study Island program be made available to all students.

More specifically, the program should be integrated into all elementary school rotator, special, or physical education classes. The Study Island program should also be incorporated at the high-school level through rotator or SAT prep courses. In summary, study results support the studied district’s decision to implement the program throughout the district.

Recommendations for Future Research

The researcher recommends that further research investigate the influence of the Study Island program when used at home and for a period longer than 15 weeks. Further research is also needed to determine if there is a correlation between the number of questions answered through the Study Island program and the GEPA raw scale score. Additionally, a study on the different attitudes taken by boys and girls when using the Study Island program could yield significant results.

As technology environments continue to increase and change, a number of issues still need to be addressed. The investigation of the interactivity between students and computers is in its infancy. More studies are needed to determine whether educators are harnessing technology in appropriate, meaningful ways. (Along these lines, my colleague and member Geyer (2007) has illustrated the differences in educational technology resources in New Jersey through her descriptive, retrospective study.) Further study is also needed because the sample population was given computer access in the current study. Future studies might examine the effectiveness of the Study Island program in settings where students have limited computer access at home and in school. Additionally, researchers could present a comparative study to determine if results are different when students answer questions the old-fashioned way, using paper and pencil.

Final Notes

In closing, this study was developed to determine if computer-enhanced learning has an influence on student achievement. The research reveals that access to computers at school, student computer skills, and access to computers at home do influence student

achievement. None of these factors, however, is directly related to integrating computers in the classroom. As a result, computer use can be tied to student performance, but not from the standpoint of enhancing instruction. These findings align with much of the related literature in the field and in existing studies.

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Appendix A

SETON HALL UNIVERSITY™

1 8 5 6

March 14, 2007

Triantafillos Parlapanides
1705 North Bayview Avenue
Seaside Park, NJ 08752

Dear Mr. Parlapanides,

The Seton Hall University Institutional Review Board has reviewed your research proposal entitled "The Influence of a Technology Treatment on Standardized G.E.P.A. Math" and has approved it as submitted under exempt status.

Please note that, where applicable, subjects must sign and must be given a copy of the Seton Hall University current stamped Letter of Solicitation or Consent Form before the subjects' participation. All data, as well as the investigator's copies of the signed Consent Forms, must be retained by the principal investigator for a period of at least three years following the termination of the project.

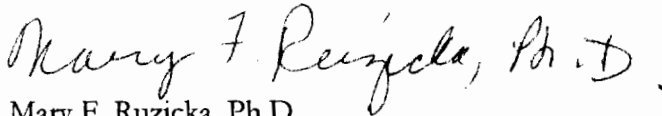
Should you wish to make changes to the IRB approved procedures, the following materials must be submitted for IRB review and be approved by the IRB prior to being instituted:

- Description of proposed revisions;
- *If applicable*, any new or revised materials, such as recruitment fliers, letters to subjects, or consent documents; and
- *If applicable*, updated letters of approval from cooperating institutions and IRBs.

At the present time, there is no need for further action on your part with the IRB.

In harmony with federal regulations, none of the investigators or research staff involved in the study took part in the final discussion and the vote.

Sincerely,



Mary F. Ruzicka, Ph.D.

Professor

Director, Institutional Review Board

cc Dr. Charles M. Achilles

Please review Seton Hall University IRB's Policies and Procedures on website (<http://www.provost.shu.edu/IRB>) for more information. Please note the following requirements:

Adverse Reactions: If any untoward incidents or adverse reactions should develop as a result of this study, you are required to immediately notify in writing the Seton Hall University IRB Director, your sponsor and any federal regulatory institutions which may oversee this research, such as the OHRP or the FDA. If the problem is serious, approval may be withdrawn pending further review by the IRB.

Amendments: If you wish to change **any** aspect of this study, please communicate your request in writing (with revised copies of the protocol and/or informed consent where applicable and the Amendment Form) to the IRB Director. The new procedures cannot be initiated until you receive IRB approval.

Completion of Study: Please notify Seton Hall University's IRB Director in writing as soon as the research has been completed, along with any results obtained.

Non-Compliance: Any issue of non-compliance to regulations will be reported to Seton Hall University's IRB Director, your sponsor and any federal regulatory institutions which may oversee this research, such as the OHRP or the FDA. If the problem is serious, approval may be withdrawn pending further review by the IRB.

Renewal: It is the principal investigator's responsibility to maintain IRB approval. A Continuing Review Form will be mailed to you prior to your initial approval anniversary date. **Note:** No research may be conducted (except to prevent immediate hazards to subjects), no data collected, nor any subjects enrolled after the expiration date.

REQUEST FOR APPROVAL OF RESEARCH, DEMONSTRATION OR RELATED ACTIVITIES INVOLVING HUMAN SUBJECTS

All material must be typed.

PROJECT TITLE: *An analysis of the implementation and influence of a technology treatment on eighth grade students at Central Regional Middle School, in southern New Jersey and its impact on G.E.P.A. math scores.*

CERTIFICATION STATEMENT:

In making **this application**, I (we) certify that I (we) have read and understand the University's policies and procedures governing research, development, and related activities involving human subjects. I (we) shall comply with the letter and spirit of those policies. I(we) further acknowledge my(our) obligation to (1) obtain written approval of significant deviations from the originally-approved protocol BEFORE making those deviations, and (2) report immediately all adverse effects of the study on the subjects to the Director of the Institutional Review Board, Seton Hall University, South Orange, NJ 07079.

Triantafillos Parlayanides
RESEARCHER(S) OR PROJECT DIRECTOR(S)
Triantafillos Parlayanides

8/12/06
DATE

****Please print or type out names of all researchers below signature.
Use separate sheet of paper, if necessary. ****

My signature indicates that I have reviewed the attached materials and consider them to meet IRB standards.

Dr. Charles M. Achilles EDD
RESEARCHER'S ADVISOR OR DEPARTMENTAL SUPERVISOR
Dr. Charles M. Achilles

1/30/07
DATE

****Please print or type out name below signature****

The request for approval submitted by the above researcher(s) was considered by the IRB for Research Involving Human Subjects Research at the in March 2007 meeting.

The application was approved ☒ not approved ☐ by the Committee. Special conditions were _____ were not ☒ set by the IRB. (Any special conditions are described on the reverse side.)

Nancy J. Lenzola, Ph.D.
DIRECTOR,
SETON HALL UNIVERSITY INSTITUTIONAL
REVIEW BOARD FOR HUMAN SUBJECTS RESEARCH

3/14/07
DATE

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1 8 5 6

CENTRAL REGIONAL MIDDLE SCHOOL
FOREST HILLS PARKWAY
BAYVILLE, NJ 08752

TO: Mr. David Trethaway, Superintendent

FROM: Mr. Triantafillos Parlapandis, Principal (TP)

RE: Dissertation

DATE: August 8, 2005

Enclosed is a Letter of Solicitation that I must submit to you as a requirement to conduct my dissertation. The statement of the problem is: What is the impact of technology on academic performance in the mathematic portion of the Grade Eight Proficiency Assessment Test? In response to this Letter of Solicitation I will need you to write an official letter approving the study. This study is a post hoc review of district data and does not require direct interaction between the students and myself.

It is imperative for my mentor, as well as the Institutional Review Board that I remain unbiased; therefore, I suggest that you recommend someone who can code the students' information (protecting their identities) prior to submitting it to me for analysis. Mrs. Marybeth Currie and Ms. Kathleen Kropke in guidance are excellent candidates to assist me. On the administrative level, I am sure that Mr. Douglas Corbett, Vice Principal could contribute as well.

If this meets your approval, I will need an official letter:

- Granting permission to conduct the study.
- Stating you will assign a designated person to replace identifiable student information with numerical codes prior to submitting the records and data to me.

Thank you for your consideration regarding this matter.

CC:

Mr. Douglas Corbett, Assistant Principal

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1 8 5 6

Triantafillos Parlapanides
1705 North Bayview Avenue
Seaside Park, New Jersey 08752
732-830-4945

August 8, 2005

David Trethaway
Superintendent of Schools
Central Regional School District
Forest Hills Parkway
Bayville, New Jersey, 08721

Dear Mr. Trethaway,

I am currently pursuing a doctoral degree in Educational Leadership, Management and Policy as part of the Executive Ed. D program at Seton Hall University. As a partial requirement in fulfillment of my degree, I have to conduct research and write a dissertation on a topic of interest in the field of educational administration. I would like to study the impact of technology (Study Island) on mathematical achievement on the Grade Eight Proficiency Assessment Test.

The amount of research on what works in math education is relatively thin, compared with reading. The White House under President Bush has proposed a 380 million dollar plan to improve math and science education, with the goal of producing a more skilled workforce and sustaining economic competitiveness internationally. The "Study Island" Initiative in which students are removed from their physical education classes once a week. The students were then given a 44 minute session of a mathematical tutorial computer based program that is aligned with the New Jersey Core Content Curriculum Standards. This will be a tremendous opportunity to not only provide data on mathematical research and the use of technology, but continue our efforts to provide the students of Central Regional School District with the best education possible.

The "Study Island" Initiative commenced in the 2005-2006 school year and to date the district has not conducted any empirical studies on how the academic progress and the "Study Island" program impact the mathematic portion of the Grade Eight Assessment Test.

College of Education and Human Services
Executive Ed.D. Program

1-800-273-2728

100 South Orange Avenue • South Orange, New Jersey 07079-1555

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The research will be conducted as a post hoc study of student participation during the 2005-2006 academic school year. Although this is a year long study, it is retrospective in nature; thus does not require that I, as the researcher, have any contact with the students participating in the study.

The investigation will involve two groups of students: (1) the students participating in the "Study Island" program during the 2005-2006 school year and (2) a random sample of eighth grade students from the 2004-2005 academic school year. Data will be collected from report cards (mathematical average of 1 & 2 marking periods), teacher, gender, race, attendance and NJPASS scores. All participants will be given a coded identification number assigned by the vice principal or your designee to protect the identity of the students. Only the coded identification numbers will be written on all student report cards, and assessment records prior to being released.

This data will be used to answer the following research questions:

Research question number 1: The first question the researcher will answer is what impact will the 44 minute technology treatment have in mathematical achievement on standardized testing?

Research question number 2: The second question the researcher will answer is how does the academic progress (G.P.A.) and gender have on the G.E.P.A. scores of eighth grade students in the treatment group compare with the academic progress (G.P.A.) and gender on the G.E.P.A. scores of eighth grade students not receiving the treatment.

Research question number 3: How do the main effects of G.P.A. gender, attendance, and students' NJPASS scores impact G.E.P.A. scores in the treatment group and the non-treatment group when one controls for curriculum?

Although this investigation may provide your district with a meaningful analysis of your "Study Island" Program, your participation in the study is strictly voluntary.

To preserve the anonymity of the participating students post hoc output data collected from each participant in the study will be assigned a numerical code. All references to participants will be made using their numerical codes.

Student anonymity and confidentiality will be preserved. Only the building assistant principal or your designee will have access to student identities and other personal information. The data will be sorted based on the numerical codes assigned by the assistant principal or your designee. The data will be securely stored in a locked file

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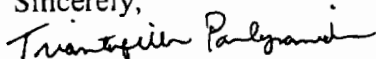
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cabinet in a room in my home for a period¹ of three⁵ years. With the exception of a statistical mentor, no additional people will have access to the data.

In closing I ask that you seriously consider granting approval to conduct this study as it has practical implications for your district. It will not only examine the implementation of the program, but also the effects on the mathematics portion of the Grade Eight Proficiency Assessment test. With NCLB legislation, the federal government has ultimately placed the high stakes accountability in the hands of district leaders who must make decisions regarding curricular changes and programs. The study presented here will give the district data and research to make informed choices regarding cost effectiveness of such a program; and conduct future research regarding the sustained effects of participation.

Thank you in advance for your time and cooperation.

Sincerely,


Triantafillos Parlapanides



Central Regional School District

PO Box C
Forest Hills Parkway
Bayville, New Jersey 08721
(732) 269-1100
Fax (732) 269-7723
www.centralreg.k12.nj.us

DENNISE E. DRIBER, Ed.D.
Asst. Superintendent of Schools

DAVID TRETHAWAY
Superintendent of Schools

JAMES H. CUMMINGS
Asst. Superintendent for Business
Board Secretary

May 5, 2006

Mr. Triantafillos Parlapanides
1705 Bayview Avenue
Seaside Park, NJ 08752

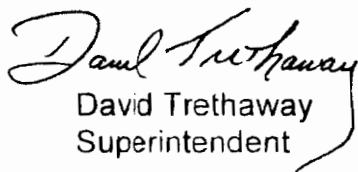
Dear Tom:

I reviewed your letter requesting permission to conduct a study regarding a pullout program, "Study Island." After carefully reviewing the district commitment and the safeguards you are willing to put into place regarding the protection of student identities and records, I am hereby granting you permission to conduct the study.

However, the approval of the study is contingent upon the basis that you will work through our guidance counselors, Mrs. MaryBeth Currie and Ms. Kathleen Kropke and establish a method to replace identifiable student information before you process any of the data. I am also requesting that you work with Mr. Douglas Corbett to facilitate the process on the administrative level.

Please meet with me at your earliest convenience to establish the guidelines for this study. I wish you good luck in this endeavor and look forward to meeting with you and receiving the information at the conclusion of your study.

Respectfully,


David Trethaway
Superintendent

DT:baj



Human Participant Protections Education for Research

Completion Certificate

This is to certify that

Triantafillos Parlapanides

has completed the **Human Participants Protection Education for Research Teams** online course, sponsored by the National Institutes of Health (NIH), on 03/23/2005.

This course included the following:

- key historical events and current issues that impact guidelines and legislation on human participant protection in research.
- ethical principles and guidelines that should assist in resolving the ethical issues inherent in the conduct of research with human participants.
- the use of key ethical principles and federal regulations to protect human participants at various stages in the research process.
- a description of guidelines for the protection of special populations in research.
- a definition of informed consent and components necessary for a valid consent.
- a description of the role of the IRB in the research process.
- the roles, responsibilities, and interactions of federal agencies, institutions, and researchers in conducting research with human participants.

National Institutes of Health
<http://www.nih.gov>

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FIRST

SETON HALL UNIVERSITY IRB APPLICATION SHEET

For office use only:

☐ Exempt

☐ Expedited

☐ Full

Application must be typed.

If more than one researcher, give information on a separate page for #1-4 for each researcher. Indicate who is Principal Investigator.

1. NAME: Triantafillos Parlapapides HOME PHONE: 732-830-4945 or 732-300-9858
EMAIL ADDRESS: tparlapapides@aol.com
2. HOME MAILING ADDRESS: 1705 North Bayview Avenue, Seaside Park, NJ 08752
3. PLACE OF EMPLOYMENT: Central Regional School District
4. POSITION OR JOB TITLE: Principal WORK PHONE: 732-269-1100 ext. 313
5. TITLE OF STUDY: The Influence of a Technology Treatment on Standardized G.E.P.A. Math.
6. Study is: (a) Thesis _____ (b) Dissertation X (c) Other [specify] _____
7. Does your research have a potential or actual financial interest of any kind (e.g. any form of payment for services, equity interests, intellectual property rights, etc.)?
____ Yes. (Please complete the Financial Conflict of Interest form at the end of this IRB application and submit with the application.)
X No
8. Name of advisor, thesis or dissertation, class professor (If applicable): Dr. Charles M. Achilles
Dept: Education, Administration and Leadership Phone: 315-789-2399
9. Anticipated starting and completion dates: September 9, 2004 to September 9, 2005
10. What is the purpose of the study? To identify the influence of a technology treatment in the form of a 44 minute computer tutorial on the mathematical portion of the Grade Eight Proficiency Assessment Test.
11. What are the hypotheses (quantitative research) or research questions (qualitative research)? This will be a quantitative study. Does technology treatment in the form of a 44 minute tutorial over a 12 week period improve students' academic achievement in the mathematics portion of the Grade Eight Proficiency Assessment Test.
12. Explain your qualifications for conducting this research. I feel very comfortable with the statistics that I will be using and Seton Hall University has prepared me well for this study. I am in my fourth year as a principal and have two additional years of experience as an assistant principal in both a high school and a middle school. I am a Doctoral candidate at Seton Hall University and have completed courses in research and statistics. I have also completed educational research courses in my master's program. I believe I am qualified to conduct this research.
13. Explain the rationale and significance of the study. The significance is to see if block scheduling at the middle school grade level effects student achievement on standardized mathematical tests.
14. Describe the subjects, removing geographic identifiers that could compromise anonymity or confidentiality: The subjects are school districts with similar district factor groups, teacher experience, and building level make-up. All information can be retrieved through the New Jersey Department of Education Report Card for each district.
Age(s) of subjects: 11-12-13
Number of subjects: Approximately 200

15. From where and how will potential subjects be identified (e.g., outpatient list, class list, etc.)?

The students will be selected randomly by a computer program. I'll use the data for the selected students

How do you have access to this population?

I will have access to the data through the Central Regional Database and through the Superintendent's designee.

16. Do you have a supervisory and/or professional relationship with the subjects? Yes X No
If yes, please explain how this relationship will not compromise the voluntaries of the subjects' participation in the study.

All of the student data will be coded by the middle school vice principal or his designee to protect student identity prior to submission for evaluation. The research design is non-experimental and retrospective in nature which precludes any interaction between the researcher and the subjects.

17. Will data be collected from or about any of the following protected populations:

- X minors (under 18 years of age; specify age) Data has already been collected through the regular testing requirements.

N/A prisoners

N/A pregnant women

N/A fetuses

N/A cognitively impaired persons

For additional requirements regarding these categories of protected subjects, consult and follow the IRB Guidelines.

18. What are your criteria for subject selection? Selection of subjects must be equitable and, in the case of protected populations [see #13 above], should reflect their special needs. IRB Guidelines also require researchers to be sensitive to the use of educationally and economically disadvantaged persons as subjects. If you are excluding women or minorities from your subject pool, you must include a scientific justification for such exclusion.

This investigation is retrospective and will examine outcome data collected from Eighth Grade clusters. The researcher will utilize coded data from students who were involved in the program. The investigation will include outcome data from two groups of students: (1) participation in technology treatment and; (2) non-participation in technology treatment. Approximately 100 students participated in the technology treatment during the 2005-2006 Academic school year. A random sample of approximately 100 students who did not participate in the technology treatment in the eighth grade will be utilized as a comparison group. Students in each of the two groups have as similar backgrounds as possible except for manipulation of the desired variables: participation in the technology treatment. The Superintendent or designee assigned each participant a three digit numerical code. This code is the only identifying student information written on the data collected by the researcher.

19. How will subjects be recruited once they are identified (e.g., mail, phone, classroom presentation)?
Include copies of recruitment letters, flyers, or advertisements, or copy of script of oral request at time of recruitment.

The investigation is retrospective: Therefore, students were not recruited to participate in the study. All data will be obtained from coded district records and coded district report cards and attendance sheets. Data are already collected and stored in a database.

20. Where will research be conducted? (be specific) Central Regional Middle & High School Database School.

21. Will deception be used? YES NO X If YES, provide the rationale for the deception:

22. Please explain debriefing procedures, if any, to be used in this study:

There is no anticipated need for debriefing. However, I shall report the results to the district administrator when requested.

23. What methodology will be taken to insure the anonymity of the subjects and the confidentiality of the data (i.e., coding system, how and where data will be stored and secured, how data will be analyzed, who will have access to data, what will happen to data after the study is completed)? If data is going to be stored electronically, what technology (i.e., firewalls) and software are being used to ensure confidentiality? Cite the strength of these. Note that researchers should retain all data collected for at least 3 years after project completion.

The Superintendent or designee will give students participating in the study a three digit code to protect their anonymity. A participant in the technology treatment cluster may receive a code of 100. A students not participating in the technology treatment may be issued a code of 200. Both students have a similar daily academic schedule. All student information submitted to the researcher will only reference the three digit code. The data will be stored in a locked file cabinet in the researcher's home. The data will be analyzed through statistical procedures and the data will only be available to the researcher and statistics mentor. The researcher will keep the stored data in a locked file cabinet for at least three years.

24. Is a subject follow-up anticipated? YES ____ NO X If Yes, for what reason?

25. Describe the design and methodology, including all statistics, IN DETAIL. What exactly will be done to the subjects?

Descriptive research is appropriate for this study, because the intent is to explain any patterns or relations in the data and not to determine cause and effect. Differential statistical analytical methods will be utilized using SPSS Software, analysis of covariance or ancova will be used to answer the three research questions.

26. Indicate how hypothesis/question of research fit methodology and design.

Descriptive research is appropriate for this study, because the intent is to explain any patterns or relations in the data and not to determine cause and effect. This researcher will base his analysis on the level of significance of $P < .05$ which is used by most social researchers.

27. Give power analysis to justify number of subjects.

This study will examine the total disaggregated G.E.P.A. test scores of participating eighth graders in the technology treatment cluster and non-treatment cluster at Central Regional Middle School. Using the level of significance of $P < .05$, and to ensure sufficient power of .80. The number of treatment levels (K) = 2 and sample size per treatment level with differences to be detected between treatment levels ($C\alpha$) of .50 a sample size of 62 or greater is required.

28. Give reliability, validity and norming information on all instruments.

The GEPA is the standard testing instrument in NJ and all students must take this examination.

29. Describe any equipment that will come in contact with the subject. Brand name and model, as well as description of its function. If electrical equipment is connected directly to the subjects, as with GSR and EFF measures, assurances concerning the safety of the equipment (technician should certify that equipment was checked within the last month) should be included.

There is no additional equipment that will come in contact with the subjects.

ATTACH ADDITIONAL SHEETS IF NECESSARY.

Include the necessary copies of any test instruments, questionnaires, etc.

Attachment A: Letter to School Districts

Attachment B: Survey Questions

DO NOT ATTACH COPIES OF SECTIONS OF GRANT PROPOSALS, DISSERTATIONS OR CLASS PROJECTS TO ANSWER THIS SITE.

SETON HALL UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN SERVICES
OFFICE OF GRADUATE STUDIES

OFF-CAMPUS DEFENSE COMMITTEE INFORMATION

Please **PRINT** or **TYPE** the following information:

Student's Name: Triantafillos Parlapanides

Committee Member's Name: Dr. Wm. Ray Heitzmann

Street Address: Villanova University

City/State/Zip: Villanova, PA 19085

Phone (daytime/evening): 610-519-4618

E-mail: ray.heitmann@villanova.edu

SETON HALL UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN SERVICES
OFFICE OF GRADUATE STUDIES

OFF-CAMPUS DEFENSE COMMITTEE INFORMATION

Please **PRINT** or **TYPE** the following information:

Student's Name: Triantafillos Parlapanides

Committee Member's Name: Dr. Dennis Driber

Street Address: Forest Hills Parkway

City/State/Zip: Bayville, NJ 08721

Phone (daytime/evening): 732-269-1100 ext. 277

E-mail: DDriber@centralreg.K12.NJ.US